

REMARKS/ARGUMENTS

Favorable reconsideration of this application is requested in view of the above amendments and in light of the following remarks and discussion.

Claims 1-17, 19-27, and 29-35 are pending. Claims 29-33 are withdrawn. Claims 34 and 35 are newly added. Claims 2, 5, 9, 14, 15, 17, 19, 21-24, and 27 are amended. Claims 18 and 28 are canceled without prejudice or disclaimer. The specification is amended. Support for the amendment to the specification can be found in the original specification, including the claims as originally filed. Support for the amendments to the claims can be found in the original application as filed. No new matter is added.

In the outstanding Office Action, the Restriction Requirement dated December 19, 2006, was made Final. Claim 18 was rejected under 35 U.S.C. § 112, as indefinite. Claims 21-23, 25, and 27 were rejected under 35 U.S.C. § 102(b) as anticipated by Watanabe et al. (Japanese Patent No. JP 06204143, herein "Watanabe"). Claims 1-5 and 8-16 were rejected under 35 U.S.C. § 103(a) as obvious over Watanabe in view of Moslehi (U.S. Patent No. 5,846,883, herein "Moslehi"). Claims 17, 18, 19, 20, and 26 were rejected under 35 U.S.C. § 103(a) as obvious over Watanabe in view of Tanaka et al. (U.S. Patent Pub. 2004/0020599, herein "Tanaka"). Claims 6-7 were rejected under 35 U.S.C. § 103(a) as obvious over Watanabe in view of Moslehi and Kawada et al. (U.S. Patent No. 5,536,359, herein "Kawada").

Regarding the rejection of Claim 18 under 35 U.S.C. § 112, second paragraph, as indefinite, Applicants respectfully submit that Claim 19, and not 18, recites the rejected limitation. In either case, Applicants respectfully traverse the rejection, but, in order to expedite prosecution of the application, Claim 19 is amended to render the rejection moot.

Claims 1 and 10

By way of review, the shower head structure and the semiconductor processing device in accordance with the invention recited in independent Claims 1 and 10 includes a shower head and a plurality of gas injection holes for providing the processing gas. It also includes at least one light introducing rod of a radiation thermometer inserted through at least one of the gas injection holes. An example of this feature is discussed in the specification at page 16, line 7 - page 17, line 11; page 18, line 8 - page 19, line 10; and shown in Figs. 1-4.

One benefit of the above-noted arrangement is a reduction of film adhering to the light introducing rod (see page 19, line 23-24).

Watanabe does not teach nor suggest at least the limitation of a shower head structure for use in a device for processing a semiconductor while a processing gas being provided into a processing space accommodating a heated substrate to be processed, comprising: a shower head including a plurality of gas injection holes for providing the processing gas; and at least one light introducing rod of a radiation thermometer inserted through at least one of the gas injection holes. Watanabe describes a shower head and radiation thermometer. Watanabe does not teach or suggest a light introducing rod of a radiation thermometer, and the outstanding Office Action has acknowledged this fact.

Moslehi describes an optical plug (604) that is inserted through a gas injection showerhead to monitor the plasma process, not through the gas injection holes. As discussed above, insertion through a gas injection hole helps prevent a film from adhering to the light introducing rod. Although Moslehi describes an optical plug (604) in Fig. 22, this is not a light introducing rod of a radiation thermometer **inserted through at least one of the gas injection holes**.

Moslehi describes the optical plug (604) as follows:

The ICP source 601 provides a vacuum-sealed optical (e.g., sapphire or quartz) plug or viewport 604 for real-time in-situ

process monitoring and control purposes by monitoring the plasma process side 620 and/or substrate 607 state parameters. For instance, FIG. 22 shows a full wafer interferometry sensor 617 mounted on top of the optical plug 604 for real-time in-situ monitoring and control of the plasma process uniformity on the substrate 607.¹

Accordingly, the optical plug is not inserted through a gas injection hole.

Claims 1 and 10 recite a light introducing rod of a radiation thermometer that is inserted through the gas injection hole, where the gas discharged from the gas injection hole prevents a film from adhering to the light introducing rod.

Thus, it is submitted that independent Claims 1 and 10 are patentable over any proper combination of the cited references.

Claims 4 and 13

Dependent Claims 4 and 13 recite an apparatus in which a gas is discharged from a lower end opening of said one of the gas injection holes to be diffused while the gas is falling toward the outside of a susceptor in the processing space; and said at least one of the gas injection holes is spaced apart from a center of the shower head such that a position of a main gas stream of the gas discharged from said at least one of the gas injection holes falls outside an outer circumference of the substrate on the susceptor when the gas stream reaches an identical horizontal level to that of an upper surface of the susceptor. An example of the above-noted arrangement can be found at page 50, line 18 - page 51, line 8; and in Fig. 20.

One benefit of the above-noted arrangement is a reduction of local thinning of a film from occurring on the surface of the wafer (see page 51, line 22-25).

As discussed above, a gas injection hole through which the light introducing rod is inserted is not taught or suggested by either Watanabe or Moslehi. Accordingly the features of Claims 4 and 13 determining the position of the gas injection holes through which the light

¹ Moslehi, col. 23, lines 39-46.

introducing rod is inserted are not taught or suggested by Watanabe and Moslehi. Therefore it is respectfully submitted that the rejection should be withdrawn.

Claim 5

Dependent Claim 5 recites that the opening area of a gas injection hole through which each of said at least one light introducing rod is inserted is larger than an opening area of a gas injection hole through which no light introducing rod is inserted by a cross sectional area of said at least one light introducing rod, an identical gas being injected through the gas injection hole and said another gas injection hole. The above-noted feature is supported in the specification at page 24, line 10-18.

One benefit of the above-noted arrangement is the improvement of intra-surface uniformity of the film thickness (see page 24, line 15-18).

Both Watanabe and Moslehi are silent regarding providing an opening area of a gas injection hole through which the light introducing rod is inserted larger than an opening area of another gas injection hole by a cross sectional area of the light introducing rod.

Accordingly, it would not have been obvious to a person of ordinary skill in the art at the time the claimed invention was made to combine Watanabe and Moslehi to include all the features of Claim 5. Therefore it is respectfully submitted that the rejection should be withdrawn.

Claims 9 and 14

Dependent Claims 9 and 14 recite that an inert gas is introduced to said at least one of gas injection holes through which said at least one light introducing rod of the radiation thermometer is inserted. The above-noted feature is supported at page 24, line 25-page 25, line 2 of the specification.

One benefit of the above-noted arrangement is the improvement of the intra-surface uniformity of the film thickness.

The outstanding Office Action states that a claim requirement of “an inert gas is introduced” of Claims 9 and 14 is a claim requirement of intended use in the pending apparatus claims based on a non-apparatus part of the invention. However, Claims 9 and 14 recited introducing “an inert gas” **where the light introducing rod of a radiation thermometer is inserted**. Therefore the limitation is not merely an intended use.

As both Watanabe and Moslehi are silent on the fact that the light introducing rod of a radiation thermometer is inserted through an inert gas injection hole, it is respectfully submitted that the rejection should be withdrawn.

Claim 15

Claim 15 recites that the semiconductor processing device includes a temperature measuring device installed at the susceptor to measure a temperature thereof; and a temperature compensator for correcting a setting temperature value of the susceptor based on a difference between a detection value of the radiation thermometer and a target temperature value of the substrate.

Watanabe does not disclose how its pyrometer (4) is configured to operate. Therefore it is respectfully submitted that the rejection should be withdrawn.

Claims 12, 17, 19 and 26

By way of review, the semiconductor processing device in accordance with the invention recited in Claim 17 includes a heater and a support member having a ring shape for supporting the susceptor by contacting a peripheral part thereof, wherein the support member is **colored for blocking heat rays emitted from the heater**.

One benefit of the arrangement recited in Claim 17 is an improvement in accuracy of the measurement of the wafer temperature (see page 44, line 19-22 of the specification).

Claims 12, 17, and 26 recite that the semiconductor processing device includes an isolation ring, installed at an upper side on the peripheral part of the susceptor, **for blocking**

heat rays. Thereby blocking the heat ray from the lower part of the susceptor to the upper part thereof through the support member (see page 46, line 19-25).

Furthermore, Claim 19 recites that the support member and the isolation ring are substantially made of a material selected from the group consisting of black ceramics of quartz containing black metal oxide including niobium oxide, quartz containing black SiC, quartz containing carbon or black AlN containing carbon. An example of the above-noted feature is discussed at page 46, line 5-18 and page 47, line 10-16. One benefit of the above-noted arrangement is reduction of the scattered and reflected light from getting into the radiation thermometer (see page 47, line 17-24).

The outstanding Office Action acknowledges that Watanabe does not teach a support member colored for blocking heat rays emitted from the heater as recited in Claim 17; an isolation ring for blocking heat rays as recited in Claims 12, 17 and 26; and the support member and the isolation ring made of a material selected from the group consisting of black ceramics of quartz containing black metal oxide including niobium oxide, quartz containing black SiC, quartz containing carbon or black AlN containing carbon as recited in Claim 19. The outstanding Office Action relies on Tanaka for the above-noted features.

Although Tanaka describes a wafer processing apparatus for wafer processing including a white colored aluminum nitride isolation ring, installed at an upper side on the peripheral part of the susceptor, Tanaka and the invention recited in the above-noted claims are structurally and functionally different from each other for at least the following reasons.

(1) since the clamp ring (402) of Tanaka is made of white-colored AlN(aluminum nitride)-based ceramics with a high thermal radiation transmissivity (see [0020]), it is unrelated to blocking heat rays emitted from the heater as claimed in Claims 12, 17 and 26. (2)

Applicants submit that a white colored aluminum nitride isolation ring of Tanaka is different from the isolation ring made of a material selected from the group consisting of black

ceramics of quartz containing black metal oxide including niobium oxide, quartz containing black SiC, quartz containing carbon and black AlN containing carbon, as recited in Claim 19, because these materials can block heat rays emitted from the heater. Therefore it is respectfully submitted that the rejection should be withdrawn.

Claim 20

Claim 20 recites that the radiation thermometer is installed at the shower head and faces toward a hole for discharging a gas; the gas is discharged from a lower end opening of the hole to be diffused while the gas is falling toward outside of the susceptor; and the hole is spaced apart from a center of the shower head such that a position of a main gas stream of the gas discharged therefrom falls outside an outer circumference of the substrate on the susceptor when the gas stream reaches an identical horizontal level to that of an upper surface of the susceptor. The feature of Claim 20 relating to determining the position of the radiation thermometer is not disclosed or suggested by Watanabe and Tanaka. Therefore it is respectfully submitted that the rejection should be withdrawn.

Claim 21

Independent Claim 21 is directed to a semiconductor processing device including a processing chamber, a susceptor, a heater, a shower head, **a heat ray introducing passage, a radiation thermometer, and a gas introducing passage**. The shower head provides the processing gas through a space formed therein, the shower head is installed at a ceiling of the processing chamber. The heat ray introducing passage is vertically formed through the shower head and separated from the space formed inside the shower head. The gas introducing passage is connected to the heat ray introducing passage to introduce a gas thereinto, and separated from the space formed inside the shower head.

The outstanding Office Action asserts that Watanabe discloses a processing chamber, a susceptor, a heater, a shower head, a radiation thermometer, and a heat ray introducing

passage (14; All Figures; [0010]) and an inert gas introducing passage (14; All Figures; [001]), but the gas feeding inlet (14) of Watanabe is not vertically formed through the shower head and separated from the space formed inside the shower head as the heat ray introducing passage of Claim 21. Further since the gas feeding inlet (14) of Watanabe is not separated from the space formed inside the shower head, the gas feeding inlet (14) of Watanabe is also different from the gas introducing passage of Claim 21 connected to the heat ray introducing passage to introduce a gas therein, and separated from the space formed inside the shower head (see [0010] and Fig. 1).

Claims 22 and 23

Claim 22 recites that the gas is discharged from a lower end opening of the heat ray introducing passage to be diffused while the gas is falling toward outside of the susceptor; and the heat ray introducing passage is spaced apart from a center of the shower head such that a position of a main gas stream of the gas discharged therefrom falls outside an outer circumference of the substrate on the susceptor when the gas stream reaches an identical horizontal level to that of an upper surface of the susceptor.

The outstanding Office Action asserts that the above-noted features of Claim 22 are inherent in Watanabe.² However, it is not sufficient for a reference to merely possibly include a recited limitation. “The fact that a certain result of characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic.” MPEP § 2112, In re Rijckaert, 9 F.3d 1531, 1534, 28 U.S.P.Q.2d 1955, 1957 (Fed. Cir. 1993). Moreover:

to establish inherency, the extrinsic evidence “must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.”

² Outstanding Office Action, page 4.

In re Robertson, 169 F.3d 743, 745, 49 U.S.P.Q.2d 1949, 1950-51 (Fed. Cir. 1999).

Finally, as set forth in MPEP § 2112, “in relying upon the theory of inherency, the Examiner **must** provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art.” (emphasis added). Ex parte Levy, 17 U.S.P.Q.2d 1461, 1464 (Bd. Pat. App. & Inter. 1990).

Applicants respectfully submit that the features recited in dependent Claim 22 are not necessarily present in Watanabe, and therefore, are not inherent.

Claim 23 recites that a distance between a center of the shower head and a center of the upper opening part of the heat ray introducing passage is set to range from 70% to 100% of a radius of the substrate.

The Office Action asserts that the claim requirement of “is set to range from 70% to 100% of a radius of the substrate” of Claim 23 is a claim requirement of intended use in the pending apparatus claims that is depending on a non-apparatus part of the invention. However, since the substrate is the object to be processed by the semiconductor processing device of claim 23, the substrate is an apparatus part of the invention of claim 23.

Additionally, Applicants respectfully submit that the relationship between the distance between the center of the shower head and a center of an upper opening defined in terms of a radius of a substrate are structural limitations and must be given patentable weight. The Federal Circuit clarified this point in In re Stencel, in which the Court held that it was improper for the PTO to ignore limitations of a driver (a mechanical tool) claimed in terms of the hardware with which the driver interacted. The Federal Circuit said:

The Commissioner argues that the failure of the lobes of the collar by radial compression and the resultant locking of the collar and pin together is not a distinguishing feature of the driver, but of the collar. The Commissioner cites *In re Best*, 562 F.2d 1252, 195 USPO 430 (CCPA 1977), and *In re Swinehart*, 439 F.2d 210, 169 USPO 226 (CCPA 1971), for the proposition that the description of the driver in the

claims is merely functional, and that its patentability must be determined against all embodiments of drivers in the prior art.

Appellant points out that the driver as claimed is indeed limited as to structure, the limiting structure being defined by the structure of the collar. For example, the driver is described in claim 1 as requiring: "the minimum distance between each flat and the rotational axis corresponding substantially to the radius of the collar at the location of the lobes after their plastic deformation".

As a matter of claim draftsmanship, appellant is not barred from describing the driver in terms of the structure imposed upon it by the collar having plastically deformable lobes. The framework --the teachings of the prior art -- against which patentability is measured is not all drivers broadly, but drivers suitable for use in combination with this collar, for the claims themselves are so limited.

There is an extensive body of precedent on the question of whether a statement in a claim of purpose or intended use constitutes a limitation for purposes of patentability. See generally *Kropa v. Robie*, 187 F.2d 150, 155-59, 88 USPQ 478, 483-87 (CCPA 1951) and the authority cited therein, and cases compiled in 2 Chisum, Patents §8.06[1][d] (1987). Such statements often, although not necessarily, appear in the claim's preamble, as in Stencel's claims.

Whether a preamble of intended purpose constitutes a limitation to the claims is, as has long been established, a matter to be determined on the facts of each case in view of the claimed invention as a whole. *In re Duva*, 387 F.2d 402, 407, 156 USPQ 90, 94 (CCPA 1967); *In re Walles*, 366 F.2d 786, 790, 151 USPQ 185, 190 (CCPA 1966). The test in determining whether a claimed invention would have been obvious is what the combined teachings of the references would have suggested to one of ordinary skill in the art. *In re Kelle*, 642 F.2d 413, 425, 208 USPQ 871, 881 (CCPA 1981). The cited references would not have taught or suggested the structure of the claimed driver in the absence of prior knowledge of Stencel's fastener system.³

Thus, it Applicants are not barred from describing the apparatus in terms of the structure imposed upon it by the substrate as recited in dependent Claim 23 even if the substrate is held by the Examiner not to be part of the apparatus. Therefore Applicants respectfully submit that the requirement of Claim 23 is not merely intended use and must be given patentable weight.

The outstanding Office Action asserts that the heat ray introducing passage of Claims 22 and 23 are disclosed by the gas feeding inlet (14) of Watanabe.

However, since the heat ray introducing passage of Claims 22 and 23 is different from the gas feeding inlet (14) of Watanabe, as stated above, the features of Claims 22 and 23 are not taught or suggested by Watanabe. Therefore it is respectfully submitted that the rejection should be withdrawn.

³ In re Stencel, 4 USPQ 1071 at 1073 (Fed. Cir. 1987) (emphasis added).

Claims 34 and 35

Claims 34 and 35 recite that the processing gas is provided into the processing space through each of said at-least-one of the gas injection holes. One benefit of the above-noted feature is the minimization of a film adhering to the light introducing rod (see page 19, line 23-24).

Both Watanabe and Moslehi are silent regarding the fact that the light introducing rod of a radiation thermometer is inserted through the gas injection hole, and the gas discharged from the gas injection hole prevents a film from adhering to the light introducing rod. Therefore it is respectfully submitted that the rejection should be withdrawn.

Claims 2, 3, 6-8, 11, 16, 24, 25 and 27

Claims 2, 3, 6-8, 11, 16, 24, 25 and 27 are also patentable over the cited references, not only because they recite all of the limitations of an independent claim discussed above, but also because Claims 2, 3, 6-8, 11, 16, 24, 25 and 27 also describe additional novel elements and features that are not described in the cited references.

For the foregoing reasons, it is respectfully submitted that this application is now in condition for allowance. A Notice of Allowance for Claims 1-17, 19-27, and 29-35 is earnestly solicited.

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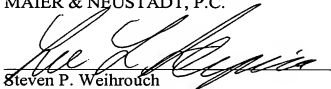
Should Examiner Zervigon deem that any further action is necessary to place this application in even better form for allowance, he is encouraged to contact Applicants' undersigned representative at the below-listed telephone number.

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